Unit - 2

Counting

Law of addition - Suppose some elements E can occur in m ways & event F can occur in n ways & suppose both events can not simontaneously. Then E or F can occur in (m+n) ways.

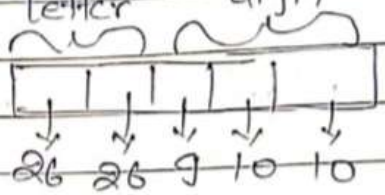
Eg Suppose there are 8 male proffesors & 5 female proffesors teaching a calculus class. Then a student can choose a calculus proffesor in (8+5) = 13 ways.

Law of multiplication - Suppose there is an event E which can occur in m ways & independent of this event, there is second event F which can occur in n ways. then combination of E & F can occur in (m x n) ways.

Eg Suppose a license plate contains two letters followed by three digit with the first digit not zero. How many different licsenses plates can be printed.

Sol^n each letter can be printed in 26 different ways, the first digit in 9

Ways & each of the other two digit in 10 ways



$26 \times 26 \times 9 \times 10 \times 10$

$= 608400$

$=$

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Sep

* The pigeonhole principle -

if n pigeonhole are occupied by (n+1) or more pigeons then at least one pigeonhole is occupied by more than one pigeon.

Generalized pigeonhole principle -

If n pigeonhole are occupied by Kn+1 or more pigeons when K is an integer then at least one pigeonhole is occupied by (K+1) or more pigeons.

Q find the minimum number of students in a class to be sure that 3 of them are borned in same month.

Here

n = 12 months is the pigeonhole

$$K+1 = 3$$

or $\boxed{K=2}$

So Kn+1

$$2 \times 12 + 1 = \boxed{25}$$

Q Suppose the department contains 13 professors then 2 of the professors born in the same months.

Soln 2 of the professor ⇒ pigeon

same month ⇒ pigeon hole

Q Suppose a laundary bag contains many red, white, & blue shocks then one need only grab 4 shocks to be sure of getting a pair with same colour.

pair of same colour ⇒ pigeon hole

4 shocks ⇒ pigeon

Q Suppose a laundary bag contains many red, white & blue shocks. find the minimum number of shocks. Then One needs to choose in order to get two pair(4 shocks) of the same colour.

$n = 3$ colour (Pigeon Hole)

$K+1 = 4$

$\boxed{K=3}$

$Kn+1 \Rightarrow 3\times3+1 = 10$

Q. find the minimum number of the student needed to guarantee that 5 of them belongs to the same class. (Freshman, Sophomore, Junior, Senior)

Here

$n = 4$ classes are pigeonhole

& $K+1 = 5$

$K = 4$

$Kn+1 \Rightarrow 4 \times 4 + 1 = 17$